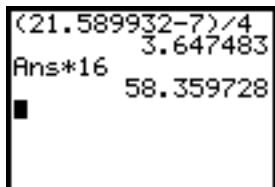


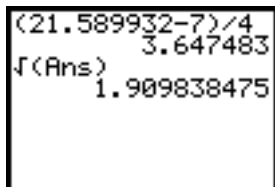
CHAPTER 1 Calculator Notes for the TI-83 and TI-83 Plus

Note 1A • Reentry

If you want to do further calculation on a result you've just found, and that result is the first number in the expression you now want to evaluate, you can simply continue the expression. For example, if you've calculated a result of 3.647483, and you want to multiply by 16, press \times 1 6 \square . If, on the other hand, you want to take the square root of that number, press \square $\sqrt{}$ and then \square \square \square to calculate $\sqrt{3.647483}$.



(21.589932-7)/4
3.647483
Ans*16
58.359728



(21.589932-7)/4
3.647483
 $\sqrt{\text{Ans}}$
1.909838475

You can also recall and edit a previous expression. Press \square \square and use the arrows to move across the expression and enter replacement characters. To delete characters press \square , and to insert new characters press \square \square . When you are finished, press \square to recalculate the revised expression.

Repeatedly pressing \square \square takes you back to previously evaluated expressions. The number of expressions you can recall depends on their length.

Note 1B • Home Screen Recursion

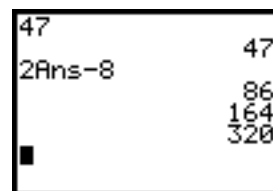
The command \square \square allows you to use the result of your last calculation in your next calculation. Also, if you press \square without pressing another key, the calculator will recompute the last expression. Using these two commands together gives you a recursion machine.

Start by entering the starting value of a sequence. Press \square . Now enter the rule, using \square \square in place of u_{n-1} . Press \square repeatedly to generate the sequence. For example, this screen shows

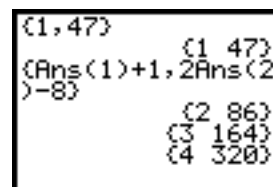
$$u_1 = 47$$
$$u_n = 2u_{n-1} - 8 \quad \text{where } n \geq 2$$

If you go too far in the sequence, you cannot back up. You must start the process over by entering the starting value again, then the rule. You also have to start over if you lose count of the number of terms in your sequence.

One way to avoid losing count of your terms is to generate two recursive sequences at once, the first sequence counting the terms of the second. Use braces, { and }, to enclose the two sequences. This example shows the starting values of 1 and 47 in braces and separated by a comma. Use Ans(1) and Ans(2) in the rules to refer to the previous values. Here Ans(2) does not mean Ans times 2, but rather the second value of the previous list. You still have to start over if you go too far, but you can keep track of how many terms you've generated.



47
2Ans-8
47
86
164
320



{1,47}
(1 47)
(Ans(1)+1,2Ans(2)-8)
(2 86)
(3 164)
(4 320)

(continued)

You can also use list recursion to keep track of more than two sequences at a time. In these screens the recursive formulas are

$$u_1 = 500 \quad \text{and} \quad u_1 = 500$$

$$u_n = (1 + 0.07)u_{n-1} \quad \text{where } n \geq 2 \quad \text{and} \quad u_n = (1 + 0.085)u_{n-1} \quad \text{where } n \geq 2$$

If the answer list is too long, scroll to the right with the arrow key to see the last value(s). You can keep answers to a fixed length using a setting on the Mode screen that specifies the number of decimal places displayed. (See **Note 1C** for instructions on moving to and from the Mode screen.)

```
(1,500,500)
(1 500 500)
(Ans(1)+1,(1+0.0
7)Ans(2),(1+0.08
5)Ans(3))
(2 535 542.5)
(3 572.45 588.6...
```

```
(Ans(1)+1,(1+0.0
7)Ans(2),(1+0.08
5)Ans(3))
(2 535 542.5)
(3 572.45 588.6...
(4 612.5215 638...
(5 655.398005 6...
```

```
Normal Sci Eng
Float 0123456789
Radian Degree
Func Par Pol Seq
Connected Dot
Sequential Simul
Real a+bi re^θi
Horiz G-T
```

```
(1,500,500)
(1 500 500)
(Ans(1)+1,(1+0.0
7)Ans(2),(1+0.08
5)Ans(3))
(2 535 543)
(3 572 589)
```

Note 1C • Navigating Screens and Menus

You'll use a variety of screens while working with the calculator. These are the ones you'll use most often.

Home Screen

Press **2nd** [QUIT]. This screen usually comes up when you turn on the calculator. You'll do almost all your calculations here.

```
u(42)
Ans/5
369098755
73819751
```

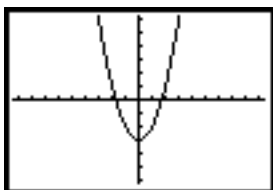
Mode Screen

Press **MODE** to change the number of decimal places displayed, the style of graph displayed, and other settings as necessary. Most of the time, your Mode screen should look like this one.

```
Normal Sci Eng
Float 0123456789
Radian Degree
Func Par Pol Seq
Connected Dot
Sequential Simul
Real a+bi re^θi
Horiz G-T
```

Graph Screen

Press **GRAPH** to display graphs.



Window Screen

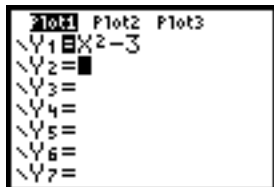
Press **WINDOW** to set the window of values that you want to graph.

```
WINDOW
Xmin=-9.4
Xmax=9.4
Xscl=1
Ymin=-6.2
Ymax=6.2
Yscl=1
Xres=■
```

(continued)

Y= Screen

Press $\boxed{Y=}$ to enter equations that you want to graph or evaluate.



Stat Edit Screen

Press $\boxed{\text{STAT}}$ $\boxed{\text{ENTER}}$ to enter and work with lists.

L1	L2	L3	2
1910	21578	18357	
1920	21578	21225	
1930	25678	24093	
1940	25434	26961	
1950	25111	29829	
1960	25182	32697	
1970	45550	35565	
L2(1)=17814			

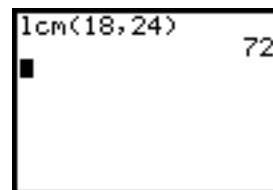
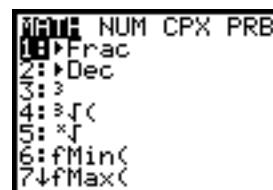
Plot Setup Screen

Press $\boxed{2\text{nd}}$ $\boxed{\text{STAT PLOT}}$ to set up a box plot, histogram, or other statistics plot.



Commands

There are keys for the most common commands you'll use—numbers and operations, for example, and $\boxed{\text{DEL}}$ (delete) and $\boxed{2\text{nd}}$ $\boxed{\text{INS}}$ (insert). You'll choose other commands from menus and submenus. For example, press $\boxed{\text{MATH}}$ and you will see four submenus: MATH, NUMber, ComPleX, and PRoBability. Use the right and left arrow keys to move among submenus. With each submenu, there is a list of commands. Use the up and down arrow keys followed by $\boxed{\text{ENTER}}$, or type a number, to select one of the commands. For example, to select the lcm(command in the NUM submenu, arrow right to NUM and then either arrow down repeatedly, or up twice, and press $\boxed{\text{ENTER}}$. You'll return to the Home screen. If you now type two integers, such as 18 and 24, separated by a comma, close the parentheses, and press $\boxed{\text{ENTER}}$, the calculator will display the least common multiple of 18 and 24, which is 72.



(continued)

Finding a Command

To find a command, you can press $\boxed{2\text{nd}}$ [CATALOG] and then the first letter of the command (letters are printed in green on the calculator surface above the keys). Then use the arrow keys to scroll to and select the command. (On some calculators you can then press $\boxed{+}$ to recall the parameters of the command.)



Note 1D • Sequence Mode

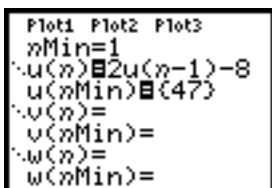
Sequence mode is a powerful way of working with recursive formulas. Press $\boxed{\text{MODE}}$, scroll down to the fourth line, and select Seq. Then go to the Y = screen.

Follow these steps to enter the recursive formula

$$u_1 = 47$$

$$u_n = 2u_{n-1} - 8 \quad \text{where } n \geq 2$$

- Set $n\text{Min}$ to be the n -value of the starting term; in this example enter 1.
- Enter the equation for $u(n)$. To get $u(n-1)$ press $\boxed{2\text{nd}}$ [u] $\boxed{\boxed{X,T,\theta,n}}$ $\boxed{-}$ $\boxed{1}$ $\boxed{\boxed{}}$.
- Set $u(n\text{Min})$ to be the value of the starting term; in this example enter 47. (The calculator will put the value in braces.)



You can find values of individual terms, as well as a range of terms, on the Home screen. To find u_{22} , press $\boxed{2\text{nd}}$ [u] (22). To find a range of terms, use a comma between the first and last term.

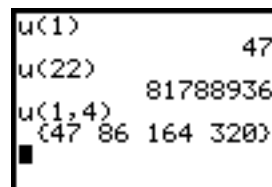
Note 1E • Graphing Sequence Mode

You can graph sequences to display numbers generated by recursive formulas. The x -axis will represent the values of n , and the y -axis will represent the values of $u(n)$.

Go to the Window screen. Set the window values to show the part of the graph you want to see.

$n\text{Min}$ = the smallest value of n you want graphed on the x -axis. You've already set this on the Y= screen.

$n\text{Max}$ = a value a little larger than the greatest value of n you want graphed.



(continued)

PlotStart = the first term of the sequence you want graphed. This is almost always 1.

PlotStep = the terms you want graphed. For example, if you want to plot every other term, PlotStep=2. PlotStep is almost always 1.

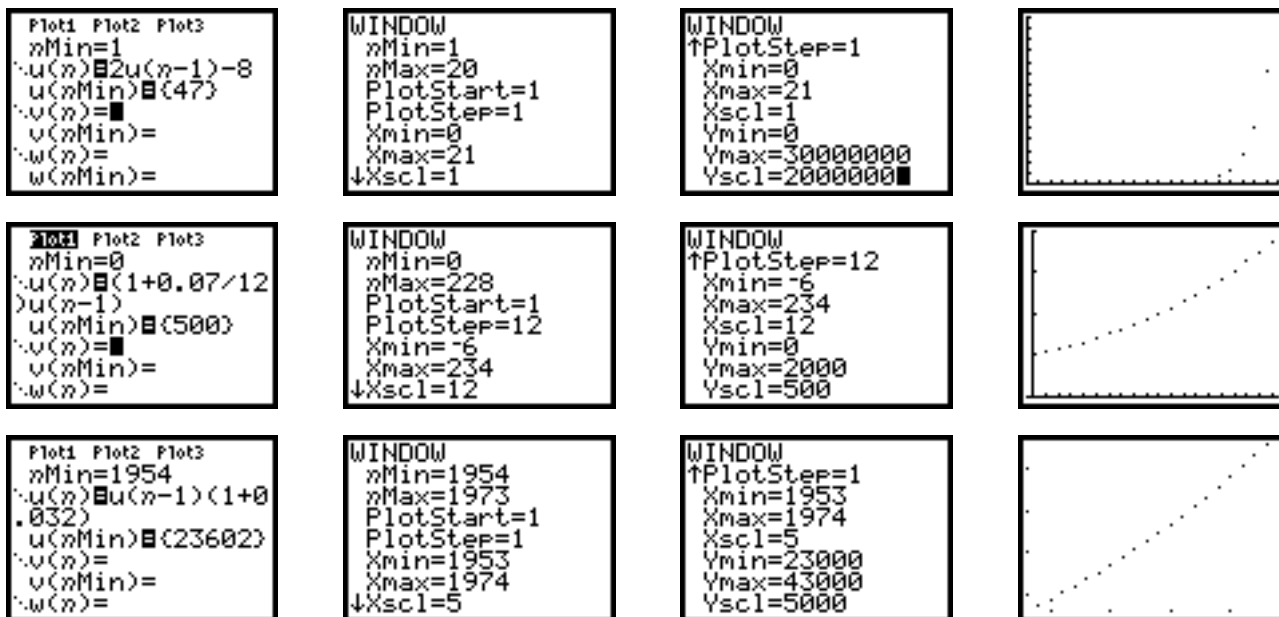
Xmin = and Xmax = the minimum and maximum values on the x-axis. These usually will be about the same as nMin and nMax, unless you want a close-up look at some part of the graph.

Xscl = and Yscl = the distance between tick marks on the two axes. The number of divisions should be less than 25. If there are too many tick marks, the axes will appear too thick.

Ymin = and Ymax = the range of function values you want graphed. Usually Ymin will be slightly less than the smallest function value and Ymax will be slightly greater than the largest function value.

Press **GRAPH** to see the graph.

These screens show graphing 20 terms of each sequence.



If you enter more than one sequence into the Y= screen, all will be graphed at the same time.

Note 1F • Looking for the Rebound

With a link cable, connect the CBR (Calculator-Based Ranger) to the calculator. Be sure to push in each plug firmly. The application will be in either the applications menu or the programs menu. Press **APPS**; if CBL/CBR is there, choose it and select 3:RANGER. If it isn't, press **PRGM**. In the submenu EXEC, arrow down to see if RANGER is one of the choices. If so, select it. Otherwise, you will need to load the program from the CBR. See **Loading the Program** in this note.

(continued)

Choose 3:APPLICATIONS from the MAIN MENU, and select your units. Choose the application 3:BALL BOUNCE. Press **[ENTER]** again for more instructions. You may now disconnect the CBR if you wish.

Hold the ball nearly a meter above the floor and the CBR half a meter above that. Release the ball as you press the trigger. When you think you have a good set of bounce data, reconnect the CBR to the calculator and press **[ENTER]**. You'll see a graph of your data. If you don't have good data showing at least five bounces, press **[ENTER]** and choose 5:REPEAT SAMPLE to repeat the experiment. When you are finished, press **[ENTER]** and choose 7:QUIT.

```
CBL/CBR APP:
1:GAUGE
2:DATA LOGGER
3:RANGER
4:QUIT
```

```
TEXASINSTRUMENTS
RANGER (V1.0)
PRESS [ENTER]
```

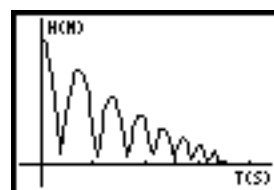
```
MAIN MENU
1:SETUP/SAMPLE
2:SET DEFAULTS
3:APPLICATIONS
4:PLOT MENU
5:TOOLS
6:QUIT
```

```
UNITS
1:METERS
2:FEET
```

```
APPLICATIONS
1:DIST MATCH
2:VEL MATCH
3:BALL BOUNCE
4:MAIN MENU
```

```
IF DESIRED,
DETACH CBR
HOLD BALL ≥
0.5 METER
UNDER CBR
[ENTER]
```

```
PRESS [TRIGGER]
ON CBR TO START
REPEAT IF
DESIRED; THEN
REATTACH CBR AND
PRESS [ENTER]
```



Loading the Program

Press **[2nd]** **[LINK]**, arrow to the RECEIVE submenu, and press **[ENTER]**. Open the pivot head of the CBR and press **[83]** or **[82/83]**. This loads the program into the calculator. If the program doesn't load, the calculator's memory may be full. The RANGER application requires about 17,500 bytes of memory. To delete items from the calculator's memory, press **[2nd]** **[MEM]**. Select 2:Mem Mgmt/Del and arrow through the choices.

Note 1G • Entering Data into Lists

The calculator keeps track of data through lists. It has six standard lists, lists L1 through L6. To refer to these lists, press **[2nd]** **[L1]** through **[2nd]** **[L6]**.

There are several ways to enter data into a list. No matter how you enter the data, you can plot and trace the data using instructions from **Notes 1H** and **1I**.

Clearing Data

If a list already has data in it, arrow up to the list name and press **[CLEAR]** **[ENTER]**.

L1	L2	L3	1
6			
.30769			
2.2361			
61			

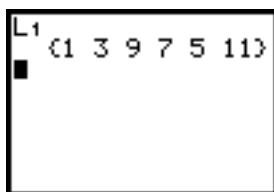
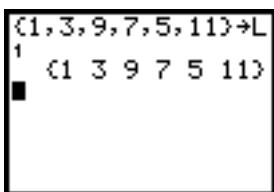
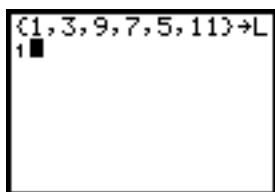
L1={6,.30769230...			

L1	L2	L3	1
L1(1)=			

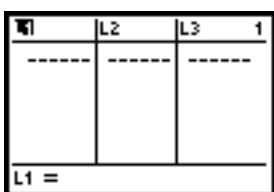
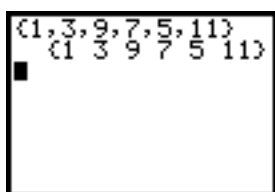
(continued)

Entering Data into a List from the Home Screen

If you are working with a short list, you may want to enter it from the Home screen. If you enter 2nd $\{ \}$ 1, 3, 9, 7, 5, 11 2nd $\{ \}$ $\text{STO} \rightarrow$ 2nd $[L1]$ ENTER , list L_1 will contain those six numbers. To view the list on the Home screen, press 2nd $[L1]$ ENTER .

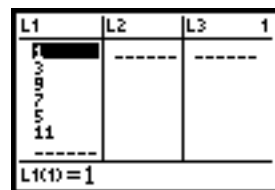
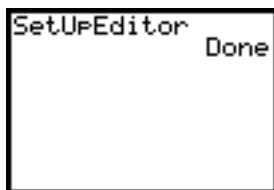
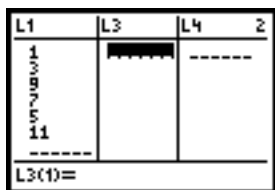


You can also enter a list into the Home screen without storing it in a stat list.

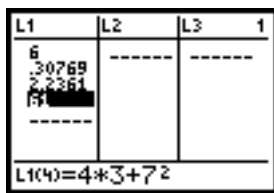
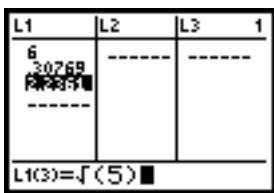
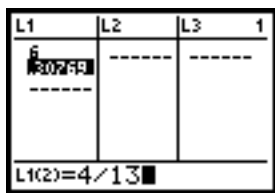


Entering Data Directly into a List

To enter a list into the Stat Edit screen, press STAT ENTER . You'll see three lists. You can arrow to the left or right to see the other three lists. (If the six standard lists don't appear, press STAT , select EDIT, arrow down to 5:SetUpEditor, then press ENTER .)



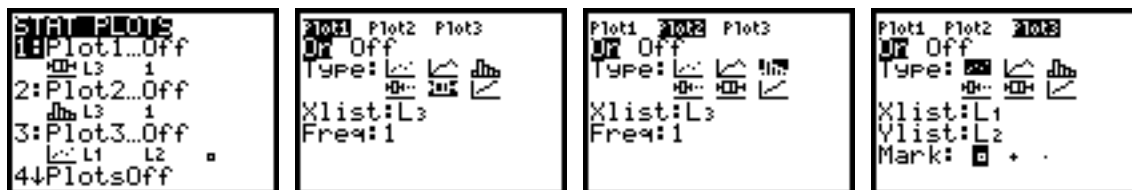
Enter or edit values in the list by typing numbers, expressions, fractions, or functions. Press ENTER after each value. All values are converted to decimals.



Note 1H • Stat Plots

To set up a plot of the data stored in a list, press $\boxed{2\text{nd}}$ [STAT PLOT] and select one of the plots by scrolling down and pressing $\boxed{\text{ENTER}}$. Then follow these steps:

- Select On.
- Select one of the six plot forms: scatter plot, xyline plot, histogram, modified box plot, regular box plot, or normal probability plot (not used in this course).
- Enter the lists to be used in the stat plot. For one-variable plots (box plots and histograms) enter one list, but for scatter plots and xyline plots enter a list into Xlist for the x -axis and a list into Ylist for the y -axis.



- For one-variable plots, Frequency indicates the number of times each data point occurs in the data set. Usually Freq is set as 1.
- For scatter plots, xyline plots, and modified box plots, select the Mark to use in the plot. If you graph more than one plot at the same time, use a different Mark for each plot.

Before viewing the plot, you need to decide what part of the graph you want to view. Press $\boxed{\text{WINDOW}}$.

Xmin = a number slightly less than the smallest x -value you want displayed.

Xmax = a number slightly greater than the largest x -value you want displayed.

Xscl = and Yscl = the distance between tick marks on the two axes. The number of divisions should be less than 25. If there are too many tick marks, the axes will appear too thick.

Ymin = a number slightly less than the smallest y -value.

Ymax = a number slightly greater than the largest y -value.

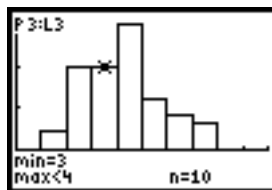
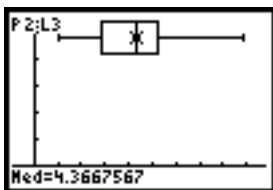
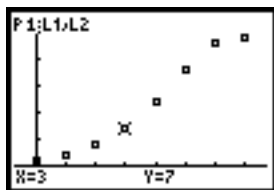
Xres = 1.

For more information about setting the window for box plots and histograms, see **Notes 2C** and **2D**.

Press $\boxed{\text{GRAPH}}$ to see the plot.

Note 1I • Tracing

If you have a plot displayed and you press **TRACE**, a “spider” will appear on the plot. Use the right and left arrow keys to move the spider along the plot. The spider’s position is given at the bottom of the screen.



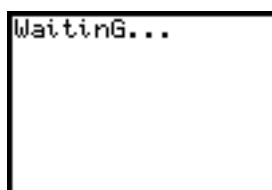
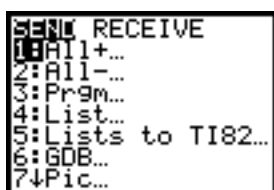
For scatter plots the data are traced in the order they appear in the list, so pressing the left arrow may not move the spider left. One-variable plots always trace the same way, histograms from the left and box plots from the center.

If you have displayed several plots at once, the spider will begin on the first stat plot that is turned on. Pressing the up and down arrow keys makes the spider jump to another stat plot. The top of the screen tells you the plot the spider is on and the lists being used.

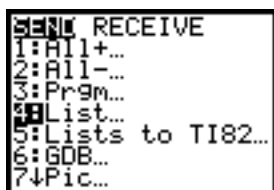
Note 1J • Linking Lists

You can copy lists from one calculator into another. This can save time and ensure that you’re working from the same data set as others. You will need a link cable and two compatible calculators. The TI-83, TI-83 Plus, TI-82, and TI-73 can all share list information, though the TI-82 can share only lists L₁ through L₆ and not any named lists.

Push the plug firmly into the ports at the bases of both calculators. Press **2nd** **[LINK]** on each calculator. On the receiving calculator, choose **RECEIVE** and press **ENTER**. This calculator should read **Waiting...** at the top of the screen.



On the calculator with the data, select **4:List...** (or **5:Lists to TI82** if you are sending to a TI-82). Arrow down to a list you want to send and press **ENTER**. This marks the list but does not send it. Mark each list you wish to send.



(continued)

When you have marked all the lists, press the right or left arrow to go to the TRANSMIT submenu. Press **ENTER**. If either calculator gives a LINK ERROR message, then push the link cable in again and start over. If the list you are sending already exists in the receiving calculator, choose 2:Overwrite to replace this list with the new list.

```
Error in Xmit
1:Quit
```

```
DuplicateName
1:Rename
2:Overwrite
3:Omit
4:Quit

L2      LIST
```

```
Receiving...
L1      LIST
L2      LIST
Done
```

Note 1K • Sequence Tables

You can view many elements of a sequence at once by using sequence tables. First enter the sequence into the Y= screen. (See **Note 1D** if you need help entering a sequence.) Then press **2nd** [TBLSET].TblStart is the smallest n -value for which you wish to see a sequence value. The value of ΔTbl specifies which terms will actually be displayed. For example, if $\Delta Tbl=3$ the table will display every third term. Press **2nd** [TABLE] to display the table. Use the up and down arrow keys to see more x -values, or the right and left arrow keys to see values of other sequences that are entered.

```
Plot1 Plot2 Plot3
nMin=1
u(n)=2u(n-1)-8
u(nMin)=47
v(n)=
v(nMin)=
w(n)=
w(nMin)=
```

```
TABLE SETUP
TblStart=2
ΔTbl=3
Indent: Auto Ask
Depend: Auto Ask
```

n	$u(n)$
2	86
5	632
8	5000
11	39944
14	319496
17	2.56E6
20	2.04E7

$n=2$

Note 1L • Random Numbers

There are several ways to generate a list of random numbers within an interval.

Random Integers

To find a random integer between 1 and 20, on the Home screen press **MATH** and arrow to PRB. Select 5:randInt(and enter 1,20), then press **ENTER**. If you want five random numbers, either press **ENTER** five times, or enter randInt(1,20,5) and press **ENTER**. If you ask for more numbers than show on one line of the screen, you can scroll to see the rest of the list. Or you can press **2nd** [RCL] **2nd** [ANS] **ENTER** to see the entire list on the screen.

```
MATH NUM CPX PRB
1:rand
2:nPr
3:nCr
4:!
5:randInt(
6:randNorm(
7:randBin(
```

```
randInt(1,20) 20
randInt(1,20,5)
{4 8 3 5 18}
randInt(1,20,15)
{8 12 13 2 1 1 ...
```

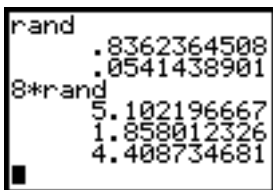
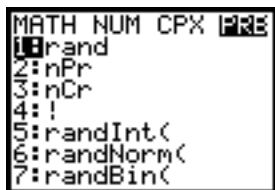
```
randInt(1,20,15)
{13 19 14 16 12...
Rcl Ans
```

```
randInt(1,20,15)
{13 19 14 16 12...
{13, 19, 14, 16, 12,
7, 5, 13, 18, 3, 10, 1
0, 6, 17, 20}
```

(continued)

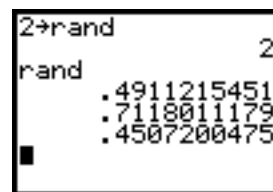
Random Decimal Numbers

Press **[MATH]**, arrow to PRB, and select 1:rand. Then press **[ENTER]** to display a random decimal number between 0 and 1. To generate a random decimal number between 0 and 8, enter $8 \times \text{rand}$.



Errors

If you are getting exactly the same random numbers as someone else, try changing the seed value. Enter a number other than 0 and press **[STO→]** **[MATH]**, select PRB, and press **[ENTER]**.



Note 1M • Finance Mode

The Finance TVM (Time Value of Money) solver will solve problems about simple loans, mortgages, and investments. Press **[APPS]** and select 1:FINANCE. (On the TI-83 press **[2nd]** **[FINANCE]**.) Choose 1:TVM Solver.... Enter values into all but one of the following positions. The solver will then calculate the missing entry. In general, negative amounts indicate money you give to the bank and positive amounts indicate money you receive.

N = the total number of payments.

$I\%$ = the annual interest rate as a percent.

PV = the principal or starting value (this is negative for investments).

PMT = the payment or regular deposit (this is negative for investments).

FV = the final value.

P/Y = payments per year.

C/Y = interest calculations per year.

$PMT:END$ $BEGIN$ indicates whether payments are made at the end or beginning of each month.

After entering the six known values, highlight the value you want to find and press **[ALPHA]** **[SOLVE]**.

This screen shows calculating the monthly payment to completely repay a 5-year (60-month) \$12,000 loan at 5.25% interest, with payments made at the end of each month. The answer, PMT , is negative because it is a payment made to the bank.

